

# **GYPSY MOTH TREATMENT MONITORING, MARYLAND 1986-1987**

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# TREATMENT MONITORING IN MARYLAND 1986-1987

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## INTRODUCTION

The Treatment Monitoring Data Base (TMDB) was implemented in the Maryland gypsy moth spray program in 1986. The purpose of TMDB is to establish a mechanism for monitoring spray project operations and results in such a way as to provide information about spray project effectiveness. The TMDB is a recordkeeping system, and it is these operational records that are summarized here, and provide the basis for evaluating the project.

This report summarizes the results of treatment monitoring for 2 years, 1986 and 1987.

Information for the TMDB comes from data collected during the course of a spray project (an example of the data collection form can be found in Appendix A). Data collection is divided into: block information, pretreatment, current treatment, on-site monitoring, aircraft calibration, and post-treatment. Data collection is standardized to the extent that the same information is requested for each block. How the information is gathered, however, can vary. Treatment monitoring is not a controlled experiment, and quality of data is a factor in interpreting results.

Data is entered into the TMDB via on-screen data entry forms, and summarized using the Dbase III+<sup>R</sup> data base management software. The following summary does not reflect all spraying in Maryland, but only those blocks (and counties) in which monitoring was conducted. In 1986 this represented a total of 98 blocks in 5 counties, and in 1987, 458 blocks in 14 counties. Some of the blocks in 1987 were not evaluated for post-treatment results; consequently, total block numbers vary for some of the remaining tables.

## BLOCK DATA

Block sizes averaged:

	<u>Dimilin</u>	<u>B.t.</u>
	-----Acres-----	
1986	136	134
1987	126	218

Some question has existed as to whether B.t. spray blocks are generally smaller than Dimilin spray blocks. Small blocks, it has been suggested, would have a higher failure rate due to reinfestation from surrounding untreated areas. The TMDB illustrates this is not true in Maryland, though some of the largest blocks are Dimilin blocks (Table 1). Later in this report, a relationship between block size and treatment failure will be examined. Figures 1 and 2

Table 1.--1987 Maryland Spray Completion Data

County	Formulation	No. of Blocks	Avg. Blk. Size (acres) (Range)	Total Acres Treated in County	Start Date	End Date	Days to Complete Treatment	Avg. Acres per Day Treated in County
Baltimore	Dimilin	86	63(10-323)	5409	5/11/87	5/16/87	5*	90
	Dipel	22	133(21-517)	2935	5/06/87	5/12/87	3*	978
Caroline	Dimilin	34	93(25-458)	3175	4/27/87	5/01/87	4	794
	Dipel	6	413(39-1258)	2480	5/01/87	5/10/87	2	1240
Carroll	Dimilin	59	58(25-172)	2622	5/05/87	5/14/87	8	524
	Dipel	8	403(56-750)	806	5/11/87	5/11/87	1	806
Cecil	Dimilin	20	141(33-395)	2818	5/05/87	5/05/87	1*	1415
	Dipel	9	37(25-67)	336	5/07/87	5/07/87	1*	336
Dorchester	Dimilin	1	45(--)	45	4/27/87	4/27/87	1	45
Frederick	Dimilin	55	264(25-3258)	14252	4/30/87	5/18/87	9	1584
	Dipel	11	397(114-1422)	4546	5/09/87	5/12/87	3	1515
Harford	Dimilin	31	115(12-843)	3553	5/05/87	5/11/87	2*	1777
	Dipel	5	140(20-513)	701	5/07/87	5/07/87	1*	701
Howard	Dimilin	7	68(26-100)	474	5/06/87	5/06/87	1	414
Kent	Dimilin	8	198(70-454)	1587	5/01/87	5/01/87	1*	1587
	Dipel	4	545(25-1851)	2181	5/07/87	5/07/87	1*	2181
Montgomery	Dimilin	27	75(28-289)	2014	4/30/87	5/06/87	3	671
	Dipel	12	160(26-956)	1915	4/30/87	5/11/87	4	479
Queen Anne	Dimilin	40	99(25-455)	3959	4/27/87	5/01/87	4	990
	Dipel	2	134(76-191)	267	5/01/87	5/07/87	2	134
Somerset	Dimilin	1	59(--)	39	4/27/87	4/27/87	1	59
Talbot	Dimilin	1	388(--)	388	4/27/87	4/27/87	1	388
Washington	Dimilin	9	104(81-5695)	9322	5/12/87	5/18/87	7	1332

\*Some spray dates unknown

NOTE: Block totals are based upon blocks with complete data.

(Appendix B) show average block sizes for each county (note that within a county, B.t. blocks are commonly larger than Dimilin blocks). Species composition is estimated in the TMDB as percent of stems that are oak, and good guesses are considered acceptable estimates. Species composition averaged 71 percent oak in 1987, and 70 percent oak in 1986. No apparent difference in percent oak exists among blocks treated with B.t. or with Dimilin.

Whether a block has been treated in the previous year is also recorded. In the 1987 data, there were 463 blocks, of which 105 had been treated the year before. As a sample of the Maryland program, the TMDB suggests a retreatment rate of 23 percent. That is, 23 percent of the time blocks may be retreated the following year. Of the 105 previously treated blocks, 64 (or 61 percent) had been treated with Dimilin, and 41 (or 39 percent) had been treated with B.t. Note that these are not retreatment rates for the individual insecticides.

#### PRETREATMENT CONDITIONS

Pretreatment egg mass densities are generally based upon surveys conducted during the Fall of the previous year. Information collected is based upon 1/40-acre plots.

Average Number of Plots/Block Used for Pretreatment Egg Mass Surveys, 1987

<u>County</u>	<u>Dimilin Blocks</u>	<u>Dipel Blocks</u>
Baltimore	5	3
Caroline	3	4
Carroll	4	8
Cecil	6	3
Dorchester	4	-
Frederick	8	7
Harford	6	8
Howard	5	-
Kent	9	8
Montgomery	5	14
Queen Anne	3	4
Somerset	6	-
Talbot	10	-
Washington	36	-

For all counties this indicates an average of 8 plots per block for Dimilin and 7 plots per block for Dipel. The estimate for Dimilin is, of course, influenced by the large number of plots in Washington County blocks which were large blocks. Combining this with average block size, information shows that Maryland uses an average of 1 plot for every 16 acres of Dimilin spray block, and 1 plot for every 33 acres of B.t. spray block to estimate pretreatment egg mass counts. Based upon this survey intensity, the following estimates of pretreatment egg mass counts were derived:

# Pretreatment Egg Mass Counts

	1986	1987
Dimilin blks.	2378 egg masses/acre	3284 egg masses/acre
B.t. blks.	1023 egg masses/acre	2277 egg masses/acre

Tables 2-5 illustrate pre-treatment egg mass counts for each county. Note the large variation that exists within each county. For example, in Table 2, Montgomery County has a mean pre-treatment count of 2,751 but a spread of 12,725 for 18 blocks.

For these spray blocks, infestation trend was subjectively categorized at the time of the pretreatment survey based upon the entomologist's knowledge of the area as:

	Increasing Pretreatment Trend	Decreasing Pretreatment Trend	Static Pretreatment Trend	Unknown Pretreatment Trend
1987 Dimilin Blocks	247	11	32	89
1987 Dipel Blocks	53	2	7	22

This indicates that population trend was expected to be increasing in most Dimilin and Dipel blocks.

## CONDITIONS AT TREATMENT

### Spray Timing:

<u>Year</u>	<u>Variable</u>	<u>B.t.</u>	<u>Dimilin</u>
1986	Dates	5/2-5/8	4/20-5/7
	Time of Day	0500-0900	0900-1800
	Pct. Foliage exp.	50-75	25-75
1987	Dates	4/30-5/12	4/30-5/18
	Time of Day	0556-2021	0549-1556
	Pct. Foliage exp.	50	50

These dates and times belong only to blocks within the TMDB and are not representative of the project as a whole. Of particular interest is the wide variation in foliage expansion for each insecticide in 1986. The 1987 data for foliage expansion was generally not recorded.

Aircraft use in the 1987 project is summarized in Table 6.

Table 2.--Thuricide 64LV Spray Blocks, Pre- and Post-density Egg Mass Estimates - 1986.

County	Pre-treatment				Post-treatment		
	N	Mean	Median	Spread	Mean	Median	Spread
Caroline	2	3588	3588	104	452	452	671
Carroll	4	503	480	372	85	20	300
Cecil	4	957	935	1000	390	125	1310
Frederick	11	970	720	1952	201	74	840
Harford	16	569	420	1927	166	75	710
Montgomery	18	2751	1580	12725	1671	567	8724
Queen Ann	1	3427	3427	0	665	665	0

Table 3.--Dimilin 25W Spray Blocks, Pre- and Post-density Egg Mass Estimates - 1986.

County	Pre-treatment				Post-treatment		
	N	Mean	Median	Spread	Mean	Median	Spread
Caroline	22	3017	1809	8150	964	115	3950
Carroll	147	1798	890	25807	23	0	1740
Cecil	16	986	488	5830	26	0	140
Frederick	81	2616	950	29750	72	0	1533
Harford	1	1714	1714	0	30	30	0
Kent	3	2321	897	5213	1850	50	5500
Montgomery	3	5482	5805	9400	10	0	30
Queen Ann	21	2809	1762	8501	1714	665	13650
Washington	5	1273	1447	1808	139	88	387



Table 4.--Dimilin 25W Spray Blocks Pre-and Post-density Egg Mass  
Estimates - 1987.

County	N	Pre-treatment			Post-treatment		
		Mean	Median	Spread	Mean	Median	Spread
Baltimore	80	3948	1592	31620	102	0	1800
Caroline	34	3112	2404	23720	1233	205	8930
Carroll	59	1817	720	11407	90	0	2630
Cecil	18	2098	1243	7755	363	28	4940
Dorchester	1	17040	17040	0	0	0	0
Frederick	55	2167	1023	13668	775	100	8405
Harford	9	2013	800	6250	34	40	80
Howard	7	2884	510	12073	140	100	326
Kent	8	2408	1617	4976	1317	733	3230
Montgomery	27	1408	840	6110	968	400	4540
Queen Ann	40	2563	1820	13310	1761	620	9460
Somerset	1	2780	2780	0	0	0	0
Talbot	1	828	828	0	76	76	0
Washington	9	904	517	1644	292	5	1853

Table 5.--Dipel 8L Spray Blocks, Pre- and Post-density Egg Mass  
Estimates - 1987.

County	N	Pre-treatment			Post-treatment		
		Mean	Median	Spread	Mean	Median	Spread
Baltimore	7	4866	1780	25773	102	30	520
Caroline	6	2303	1719	5763	2554	1103	10320
Carroll	8	1080	700	4051	206	30	956
Cecil	8	1513	490	8050	312	120	1200
Frederick	12	544	380	2048	364	170	1522
Harford	1	320	320	0	20	20	0
Kent	1	6130	6130	0	5400	5400	0
Montgomery	16	2594	452	15936	1103	519	7774
Queen Ann	2	1143	1143	955	90	90	180

Table 6.--Aircraft Use Summary - 1987

Variable Name	Tail Number							
	N4990B	N110JS	N4015P	N40814	N4021E	N4990X	N5055X	N8460V
Type of Aircraft	Bell 206B	Turbo Thrush	Turbo Thrush	Turbo Thrush	Turbo Thrush	Turbo Thrush	Turbo Thrush	Turbo Thrush
No. of blocks	16	103	22	33	23	146	56	62
Carrying Capacity (gallons)	75	350	350	450	450	350	375	350
Average Production per hour	75	257	260	480	413	315	378	332
Agitation on board	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Total boom length (ft.)		42	42	42	42	42	42	42
Nozzle type	Flat Fan	Micro-nair	Micro-nair	Micro-nair	Micro-nair	Micro-nair	Micro-nair	Micro-nair
Nozzle tip or model	8003	AU5000	AU5000	AU5000	AU5000	AU5000	AU5000	AU5000
Screen mesh	N/A	20	20	N/A	N/A	20	N/A	20
Nozzle conf. # left of center		4	4	4	4	4	4	4
Total no. of nozzles	30	8	8	8	8	8	8	8
Distance from wing tip to distal nozzle, inches		84	84	84	84	84	84	84
Nozzle angle, 45 forward, 90 straight down		180	180	180	180	180	180	180
Operating Pres, psi	40	30	42	30	28	42	31	35
Flow rate, gal/min.	9.0	29.0	29.4	29.5	29.5	29.6	29.7	29.1
Swath width, ft.	75	120	120	120	120	120	120	120
Aircraft speed, mph	60	120	120	120	120	120	120	120
Estimated droplet size (VMD)	318	480	480	480	480	480	480	480
Estimated droplet density sq. cen.	10	10	10	7	7	10	7	10

Rainfall after treatment (.25" or more within 48 hours) is summarized as:

	Yes	No	Unknown
1987 Dimilin Blocks	46	125	207
1987 Dipel Blocks	6	17	61

Two aspects of this table are of interest: one, is of the blocks where rainfall information is known a large percentage of them had rainfall occur (6 of 23 for Dipel, and 46 of 171 for Dimilin); secondly, information about rainfall is unknown for large numbers of blocks. This is a hazardous position, particularly with Dipel.

#### POST-TREATMENT RESULTS

Tables 2-5 and Figures 3-6 (Appendix B) illustrate pre- and post-treatment egg mass counts for 1986 and 1987. Because of the large number of zeroes in the post-treatment data, the medians are used in Figures 3-6. Tables 7 and 8 illustrate median percent egg mass reductions for each county in 1986 and 1987. Note that some reductions are based upon 1 block for the county. These can be further summarized as:

#### Average Percent Egg Mass Reduction (using medians)

	1986	1987
Dimilin	94%	86%
Thuricide 64LV	84%	-
Dipel 8L	-	60%

The 60 percent reduction in egg mass density for Dipel in 1987 is due partly to the poor performance within Montgomery County. Without this county, average egg mass reduction for Dipel would be 70 percent.

Treatment evaluation requires that some criteria of success be established. In Maryland, these criteria have been defined as:

	<u>Average Post-Treatment Egg Mass Density</u>	and	<u>Percent Reduction from Pre-treatment</u>
Success 1	250 or below	and	greater than 60%
Success 2	250 or below	and	less than 60%
Failure 1	Above 250	and	greater than 60%
Failure 2	Above 250	and	less than 60%

The 250 egg masses/acre represents a threshold above which retreatment would be recommended, hence its use in defining success. The 60 percent reduction pre to post egg mass count is an arbitrary qualification. That is, a

Table 7.--Median Percent Egg Mass Reduction<sup>1/</sup> for Formulations and Counties in Maryland - 1986.

County	Dimilin 25W		Thuricide 64LV	
	No. Blocks	Percent Reduction	No. Blocks	Percent Reduction
Caroline	22	93.6	2	87.4
Carroll	147	100	4	95.8
Cecil	16	100	4	86.6
Frederick	81	100	11	89.7
Harford	1	98.2	16	82.1
Howard	2	100	--	--
Kent	3	94.4	--	--
Montgomery	3	100	18	64.1
Queen Ann	21	62.2	1	80.5
Washington	5	93.9	--	--

<sup>1/</sup> ((pre em/ac - post em/ac)/pre em/ac) x 100.

Table 8.--Median Percent Egg Mass Reduction<sup>1/</sup> for Formulations and Counties in Maryland - 1987

County	Dipel 8L		Dimilin 25W	
	No. Blocks	Percent Reduction	No. Blocks	Percent Reduction
Baltimore	7	98.3	80	100
Caroline	6	35.8	34	91.4
Carroll	8	95.7	59	100
Cecil	8	75.5	18	97.7
Dorchester	-	--	1	100
Frederick	12	55.2	55	90.2
Harford	1	94	9	95
Howard	-	--	7	80.3
Kent	1	11.9	8	54.5
Montgomery	16	-14.8	27	52.3
Queen Ann	2	92.1	40	65.9
Somerset	-	--	1	100
Talbot	-	--	1	90.8
Washington	-	--	9	91

<sup>1/</sup> ((pre em/ac - post em/ac)/pre em/ac) x 100.

post-treatment count of 220 is a more qualified success if the pre-treatment count was 2000, than if it was 300. To that extent, Success 1 represents the best condition of success, and failure 2, the worst condition of failure. Treatment results are summarized for 1986 and 1987 in Tables 9 and 10.

The overall treatment success rates (combining categories 1 and 2) for 1986 and 1987 are:

	<u>Dimilin 25W</u>	<u>Dipel 8L</u>	<u>Thuricide 64LV</u>
1986	88% (265/301)		55% (31/56)
1987	77% (251/349)	49% (30/61)	

This summary indicates a considerably higher success rate in Dimilin blocks than in B.t. blocks (numbers in parentheses are: number of blocks treated successfully/total number of blocks). As indicated earlier, egg mass reduction appears to occur in the B.t. blocks, but not enough to result in post-treatment egg mass counts meeting criteria for success. These numbers suggest that B.t. treated blocks would require retreatment at a much greater rate than Dimilin blocks. In fact, for 1987, 23 percent of the Dimilin blocks and 51 percent of the Dipel blocks will require retreatment in 1988 (using the State's criteria).

The following tabulation shows treatment success and failure related to pretreatment egg mass densities:

<u>Pre-treatment Egg Mass Count Category</u>	<u>No. of Success Blocks</u>	<u>No. of Failed Blocks</u>
-----Dimilin 25W-----		
0-1000	122(.78)*	34
1001-2500	60(.69)	27
2501-5000	33(.57)	25
5000+	37(.73)	14
-----Dipel 8L-----		
0-1000	23(.58)	17
1001-2500	2(.20)	8
2501-5000	2(.50)	2
5000+	3(.50)	3

\* Note: .78 is 78% of the blocks in this pre-treatment egg mass density category were successfully treated.

Note in this summary that most of the Dipel blocks had pretreatment egg mass counts of less than 1,000. Nevertheless, a relationship between egg mass density and treatment success with Dipel is not apparent.

Table 11 illustrates block size with respect to treatment success. It is commonly thought that smaller blocks have a greater treatment failure rate, though this is not supported in Maryland's treatment monitoring data base. Table 12 shows treatment success and failure related to environmental conditions at the time of treatment. Foliage expansion is recorded in terms of

Table 9.--Treatment Success and Failure<sup>1/</sup> by Formulation and County--1986

County	Formulation	No. of Blocks	Success 1	Success 2	Failure 1	Failure 2
Caroline	Dimilin 25W	22	12(55%)	0	2(9%)	8(36%)
	Thuricide 64LV	2	1(50%)	0	1(50%)	0
Carroll	Dimilin 25W	147	142(97%)	2(1%)	2(1%)	1(1%)
	Thuricide 64LV	4	3(75%)	0	0	1(25%)
Cecil	Dimilin 25W	16	16(100%)	0	0	0
	Thuricide 64LV	4	3(75%)	0	0	1(25%)
Frederick	Dimilin 25W	81	76(94%)	0	5(6%)	0
	Thuricide 64LV	11	7(64%)	0	1(9%)	3(27%)
Harford	Dimilin 25W	1	1(100%)	0	0	0
	Thuricide 64LV	16	11(69%)	2(13%)	1(6%)	2(13%)
Howard	Dimilin 25W	2	2(100%)	0	0	0
Kent	Dimilin 25W	3	2(67%)	0	0	1(33%)
Montgomery	Dimilin 25W	3	3(100%)	0	0	0
	Thuricide 64LV	18	6(33%)	2(11%)	4(22%)	6(33%)
Queen Anne	Dimilin 25W	21	5(24%)	0	5(24%)	11(52%)
	Thuricide 64LV	1	0	0	1(100%)	0
Washington	Dimilin 25W	5	4(80%)	0	1(20%)	0

			Post-Treatment Egg Mass Density		Reduction from Pretreatment
<sup>1/</sup> Success 1	is	250 or less	and	greater than 60%	
Success 2	is	250 or less	and	less than 60%	
Failure 1	is	above 250	and	greater than 60%	
Failure 2	is	above 250	and	less than 60%	

Table 10.--Treatment Success and Failure<sup>1/</sup> by Formulation and County--1987

County	Formulation	No. of Blocks	Success 1	Success 2	Failure 1	Failure 2
Baltimore	Dimilin 25W	80	73(91%)	0	4(5%)	3(4%)
	Dipel 8L	7	6(86%)	0	1(14%)	0
Caroline	Dimilin 25W	34	19(56%)	0	5(15%)	10(29%)
	Dipel 8L	6	0	0	2(33%)	4(67%)
Carroll	Dimilin 25W	59	55(93%)	1(2%)	1(2%)	2(3%)
	Dipel 8L	8	5(63%)	0	1(13%)	2(25%)
Cecil	Dimilin 25W	18	14(78%)	0	2(11%)	2(11%)
	Dipel 8L	8	5(63%)	0	0	3(37%)
Frederick	Dimilin 25W	55	34(62%)	2(4%)	9(16%)	10(18%)
	Dipel 8L	12	5(42%)	2(17%)	1(8%)	4(33%)
Harford	Dimilin 25W	31	31(100%)	0	0	0
	Dipel 8L	1	1(100%)	0	0	0
Howard	Dimilin 25W	7	4(57%)	1(14%)	1(14%)	1(14%)
	Dipel 8L	1	0	0	0	0
Kent	Dimilin 25W	8	4(50%)	0	1(13%)	3(37%)
	Dipel 8L	1	0	0	0	1(100%)
Montgomery	Dimilin 25W	27	9(33%)	1(4%)	4(15%)	13(48%)
	Dipel 8L	16	3(19%)	1(6%)	3(19%)	9(56%)
Queen Anne	Dimilin 25W	40	16(40%)	0	9(23%)	15(37%)
	Dipel 8L	2	2(100%)	0	0	0
Somerset	Dimilin 25W	1	1(100%)	0	0	0
Talbot	Dimilin 25W	1	1(100%)	0	0	0
Washington	Dimilin 25W	9	6(67%)	1(11%)	0	2(22%)

		Post-Treatment Egg Mass Density		Reduction from Pretreatment
<sup>1/</sup> Success 1	is	250 or less	and	greater than 60%
Success 2	is	250 or less	and	less than 60%
Failure 1	is	above 250	and	greater than 60%
Failure 2	is	above 250	and	less than 60%

Table 11.--Treatment Success Related to Block Size--1987

Dimilin 25W			
Block Size Acres	No. of Blocks	% Success	% Failure
10-100	243	75% (182) <sup>1/</sup>	25% (61)
101-300	68	57% (39)	43% (29)
301-600	16	63% (10)	37% (6)
601-1000	3	67% (2)	33% (1)
1000+	7	57% (4)	43% (3)

Dipel 8L			
Block Size Acres	No. of Blocks	% Success	% Failure
10-100	28	54% (15) <sup>1/</sup>	46% (13)
101-300	12	50% (6)	50% (6)
301-600	7	43% (3)	57% (4)
601-1000	3	33% (1)	37% (2)
1000+	2	50% (1)	50% (1)

<sup>1/</sup>Numbers in parentheses are numbers of blocks in the category.



Table 12.--Environmental Conditions

1986				
Variable Name	Dimilin 25W		Thuricide 64LV	
	Success Blocks	Failure Blocks	Success Blocks	Failure Blocks
-----Averages-----				
Foliage expansion, %	54.9 (42)*	41.5 (48)	52.5 (17)	54.2 (6)
Wind speed, mph	0.5 (269)	2 (79)	2.4 (35)	1.2 (21)
Temperature, °F	66.6 (46)	68.3 (71)	58.9 (18)	59.1 (10)
Relative humidity, %	69.6 (46)	58.4 (71)	65.9 (18)	57.2 (10)

1987				
Variable Name	Dimilin 25W		Dipel 8L	
	Success Blocks	Failure Blocks	Success Blocks	Failure Blocks
-----Averages-----				
Foliage expansion, %	50 (37)	50 (40)	50 (2)	50 (6)
Wind speed, mph	2.8 (210)	3.4 (81)	2.3 (24)	4.6 (15)
Temperature, °F	56.1 (178)	49 (72)	61.3 (21)	59.1 (13)
Relative humidity, %	66.4 (178)	70.3 (72)	69.2 (21)	59.6 (13)

<sup>1/</sup>Success is a post-treatment egg mass count less than 250/acre, failure is a post-treatment egg mass count of 250 or greater.

\*Numbers in parentheses indicate number of observations.

oak. Wind speed is estimated with a hand-held anemometer, and relative humidity with a sling psychrometer. The only real difference appears to be in relative humidity in 1986. Both Thuricide and Dimilin failure blocks appear to have significantly lower relative humidities than the success blocks. This also appears true for Dipel failure blocks in 1987. This apparent relationship indicates a problem with respect to insufficient spray deposit reaching the target.

Since relative humidity measurements may be estimates, a check upon this variable can be obtained by using time of day related to block failure. This information is depicted in Figures 7-10 (Appendix B). Patterns that are apparent relate to the high failure rate for evening Dimilin spraying in 1986, and the high failure rate for afternoon Dipel spraying in 1987. Evening Dimilin spraying in 1987 was curtailed as shown in Figure 9.

The 1987 estimates of treatment success for each county are shown below. Estimates are defined as y/n, where y is the number of successfully treated blocks (categories 1 and 2 combined), and n is the total number of blocks for the county for that insecticide.

<u>County</u>	<u>Dimilin</u>	<u>B.t.</u>
Baltimore	.91	.85
Caroline	.56	0.00
Carroll	.95	.63
Cecil	.78	.63
Frederick	.47	.58
Harford	1.00	1.00
Howard	.71	-
Kent	.50	-
Montgomery	.37	.25
Queen Anne	.40	-
Washington	.78	-

Only counties with more than 2 blocks per insecticide are represented. This can be read as, for example, in Baltimore County there are a sample of 80 Dimilin treated blocks in the TMDB for 1987. Of the 80, 73 or 91 percent were successfully treated. The estimate of success for using Dimilin in Baltimore County in 1987 is .91. The very low estimates in Montgomery County are perplexing. Figures 11-12 show treatment success related to tail number. Note the high failure rate for N4990B, a Bell helicopter. Treatment by this aircraft was exclusively in Montgomery County. Its Dipel failure rate was 12 out of 14 blocks in the county, while the 2 Dimilin blocks treated by this aircraft in the same county were successes. The failure rate of this aircraft with Dipel, however, is high enough to warrant checking its calibration and spray deposit information.

## RECOMMENDATIONS

1. The failure rates shown for Dimilin and B.t. are based upon pretreatment and post-treatment egg mass counts. If egg mass counts are to be used to evaluate project results, some attention should be given to accuracy of the estimates. Survey error can be obtained through estimates of egg mass density sample variance, and the use of confidence intervals (using the t distribution). These estimates can enhance the quality of information regarding treatment success.

2. Results with Dimilin indicate about 10-20 percent of the blocks are not successfully treated. In 1986, some application problems existed during evening spraying as evidenced by the data. In 1987, there are no apparent reasons for the failures, though some counties (Caroline, Frederick, Kent, Montgomery, and Queen Anne) had the majority of problems. These counties also had problems in 1986, possibly for different reasons. In 1988, Dimilin spray deposit should be closely monitored in these counties.

3. Results with B.t. show good population reduction (60-84 percent). The reduction, however, is often not sufficient to produce a successful treatment.

Two common concerns regarding the use of B.t. are: 1) B.t. blocks are generally smaller and, 2) B.t. failures increase as pretreatment egg mass density increases. Both of these concerns are shown to be misconceptions when applied to the use of B.t. in Maryland.

The high failure rate of B.t. in Montgomery and Caroline Counties should be of concern. In Montgomery County, the performance of the Bell 206 helicopter may be partly responsible for the failures. The aircraft may not have been calibrated correctly (though TMDB information does not support this), or the spray system may not have been functioning properly. Insufficient data exists to evaluate spray timing in this county. In 1988, spray deposit should be closely monitored in these counties.

4. All counties with a success rate of less than .50 should have the program in that county evaluated for manpower, training, logistics of treatment, and gypsy moth population pressure.

APPENDIX A

### BLOCK INFORMATION

1. State / / /
2. County / / / / / / / / /
3. Block name/number / / / / / / /
4. Block acres / / / / / /
5. Species composition / / / /  
(% oak)
6. Lower elevation / / / / / -/ft
7. Upper elevation / / / / / -/ft
8. Enter distance to nearest untreated and infested area (defoliating population). Enter zero if adjacent. / / / . / / mi.
9. Was the block treated in 1986 (Y, N or U) /
10. If Y in 9, enter exact name of insecticide used in 1986--  
ex. Dipel 8L, Thuricide 64L7 / / / / / / / / / / / / / / /
11. If Y in 9, rate of application in 1986 (ex. 128) / / / / oz/ac.
12. If B.t. in 10, BIU/acre / / /
13. If other than B.t., active ingredient/acre in lbs. (ex. 1.00=1 lb/ac  
or 9.99 for unknown) / / . / / /

## PRETREATMENT

14. Egg mass density per acre prior to treatment (fall of 1986 or spring of 1987) - (if unknown, 99999) //////
15. Survey type   / 5 min. walk   / fixed   / FV   / Other
16. No. of plots or walks within block   /
17. If 5 minute walk in 15, indicate equation (Eggen) used  
  / 1   / 2   / 3   / 4   / Other
18. Infestation trend   / increasing   / static   / decreasing
19. Approximate egg mass size   / dime   / nickel   / quarter
20. Egg mass viability (% viable per mass) (if unknown, 999) ////
21. Defoliation in 1986   / 0-30%   / 30-60%   / 60%+   / unknown
22. Defoliation estimate in 21 based on   / aerial sketch   / ground  
  / photo   / guess

**CURRENT TREATMENT**

23. Material being applied in 1987 \_\_\_\_\_  
                    (ex. Dipel 8L)
24. BIU/acre \_\_\_\_  
     or  
Active ingredient \_\_./\_\_\_\_/ (ex. 0.06)
25. Rate (oz/acre) \_\_\_\_\_
26. Name of sticker, if used \_\_\_\_\_
27. Percent of total volume that is sticker \_\_\_\_./\_\_\_\_
28. Name of other additive, if used \_\_\_\_\_

# ON-SITE MONITORING

Block number/name                     

County                     

Aircraft Tail no.                     

App. 1

App - 2

- |   |  |   |
|---|--|---|
| 29. Date of application   | <u>    </u> / <u>    </u> / <u>    </u> - <u>    </u> / <u>    </u> / <u>    </u>                              | <u>    </u> / <u>    </u> / <u>    </u> - <u>    </u> / <u>    </u> / <u>    </u>                     |
| 30. Time application starts   | <u>    </u> / <u>    </u> / <u>    </u> / <u>    </u> / <u>    </u>  | <u>    </u> / <u>    </u> / <u>    </u> / <u>    </u> / <u>    </u>                                   |
| 31. Time application ends   | <u>    </u> / <u>    </u> / <u>    </u> / <u>    </u> / <u>    </u>  | <u>    </u> / <u>    </u> / <u>    </u> / <u>    </u> / <u>    </u>                                   |
| 32. Foliage expansion (999 if unknown)  | <u>    </u> / <u>    </u> / <u>    </u> / <u>    </u>  | <u>    </u> / <u>    </u> / <u>    </u> / <u>    </u>   |
| 33. Foliage condition<br>(Wet, Dry, Unknown) (W,D,U)  | <u>    </u> / <u>    </u>  | <u>    </u> / <u>    </u>   |
| 34. Most of the larvae are instar,<br>1, 2, 3, 4, 5, 6, 9 if unknown  | <u>    </u> / <u>    </u>  | <u>    </u> / <u>    </u>   |
| 35. Larval instar determined by<br>(1) close inspection of 5 or<br>more larvae<br>(2) ground observation or inspection<br>of less than 5 larvae | <u>    </u> / <u>    </u>  | <u>    </u> / <u>    </u>   |
| 36. Wind speed (mph)<br>(99 if unknown)   | <u>    </u> / <u>    </u> / <u>    </u>  | <u>    </u> / <u>    </u> / <u>    </u>   |
| 37. Wind speed measured in block (Y or N)   | <u>    </u> / <u>    </u>  | <u>    </u> / <u>    </u>   |
| 38. Temperature Degrees F<br>(999 if unknown)   | <u>    </u> / <u>    </u> / <u>    </u> / <u>    </u>  | <u>    </u> / <u>    </u> / <u>    </u> / <u>    </u>   |
| 39. Temperature measured in block (Y or N)  | <u>    </u> / <u>    </u>  | <u>    </u> / <u>    </u>   |
| 40. Relative humidity (999 if unknown)  | <u>    </u> / <u>    </u> / <u>    </u> / <u>    </u>  | <u>    </u> / <u>    </u> / <u>    </u> / <u>    </u>   |
| 41. Relative humidity measured in block<br>(Y or N)   | <u>    </u> / <u>    </u>  | <u>    </u> / <u>    </u>   |
| 42. Spray deposit in the block is<br>observed to be:  | <u>    </u> / <u>    </u> good coverage<br><u>    </u> / <u>    </u> poor<br><u>    </u> / <u>    </u> unknown | <u>    </u> / <u>    </u> good<br><u>    </u> / <u>    </u> poor<br><u>    </u> / <u>    </u> unknown |
| 43. Rainfall (.25" or more) within<br>48 hrs. of treatment (Y, N, U)  | <u>    </u> / <u>    </u>  | <u>    </u> / <u>    </u>   |
| 44. Freezing (below 33 deg. F)<br>temperatures 5 days before or<br>5 days after application<br>(Y, N, or U)                                     | <u>    </u> / <u>    </u>  | <u>    </u> / <u>    </u>   |

## AIRCRAFT CALIBRATION DATA

45. Aircraft type, (ex. Turbo Thrush, / / / / / / / / / / / / / / / /  
use 2 lines if necessary) / / / / / / / / / / / / / / / /
46. Tail number / / / / / / / /
47. Carrying capacity as used / / / / / gal.
48. Estimated ave. production / / / / / acres per hour
49. On board agitation (Y or N) / /
50. Total boom length / / / / / feet
51. Nozzle type / / flat fan / / micronair / / beecomist  
other / / / / / / / / / / /
52. Nozzle tip size/model / / 8003 / / 8004 / / 8005 / / 8020  
Other / / / / /  
/ / AU4000 / / AU5000 Other / / / / / / / /
53. Screen mesh / / / / / 999 if no screen
54. Total number of nozzles / / / /
55. Number of nozzles left of center / / / /
56. For fixed wing, indicate distance from wing tip to distal (outer)  
most nozzle  
/ / / inches beyond tip  
/ / / inches before tip  
/ / / 99 if at tip
57. Nozzle angle, 45 is forward, 90 is straight down / / / /
58. Operating pressure / / / / psi
59. Calibrated flow rate / / / / . / / gal/min.
60. Estimated aircraft speed during application / / / / mph.
61. Swath checked over cards (Y or N) / /
62. Assigned effective swath width / / / / / feet
63. Estimated droplet size (VMD) / / / / /  
(999 if unknown)
64. Estimated minimum droplet density / / / / /  
as used for effective swath, 999 if unknown

POST-TREATMENT

Block number/name       

County       

65. Average percent defoliation of trees in block,  
on target species        %

66. Percent of block defoliated        %

67. Survey type    ground    aerial sketch    photo

68. Larval density estimated from bark flaps         
(9999 if unknown)

69. Number of bark flaps per block         
(999 if unknown)

70. Post-treatment egg mass density        em/ac.  
(99999 if unknown)

71. Average egg mass size    dime    nickel    quarter

72. Survey type    5 min. walk    fixed    FV    Other

73. If 5 min. walk in 70, indicate equation (Eggen) used  
   1    2    3    4    Other

74. No. of plots or walks within block



APPENDIX B

Figure 1.

AVERAGE BLOCK SIZE BY FORMULATION AND  
COUNTY IN MARYLAND - 1986

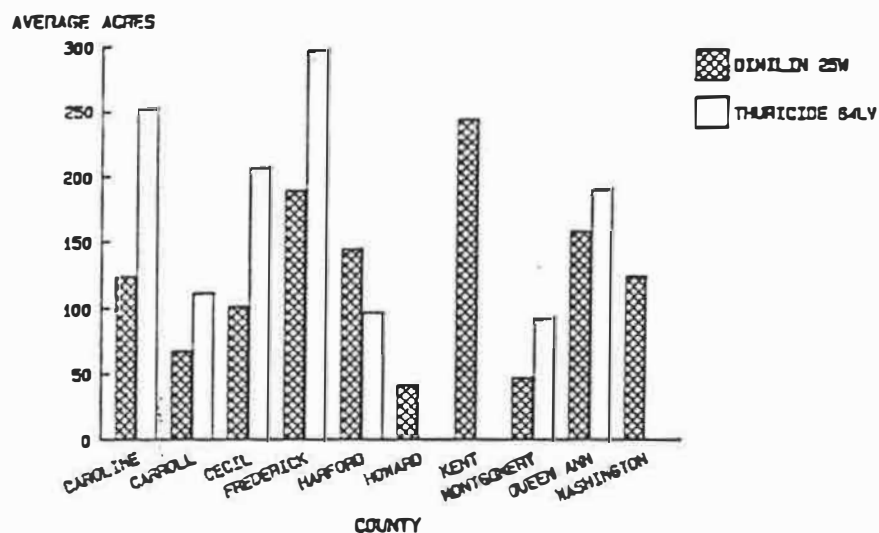
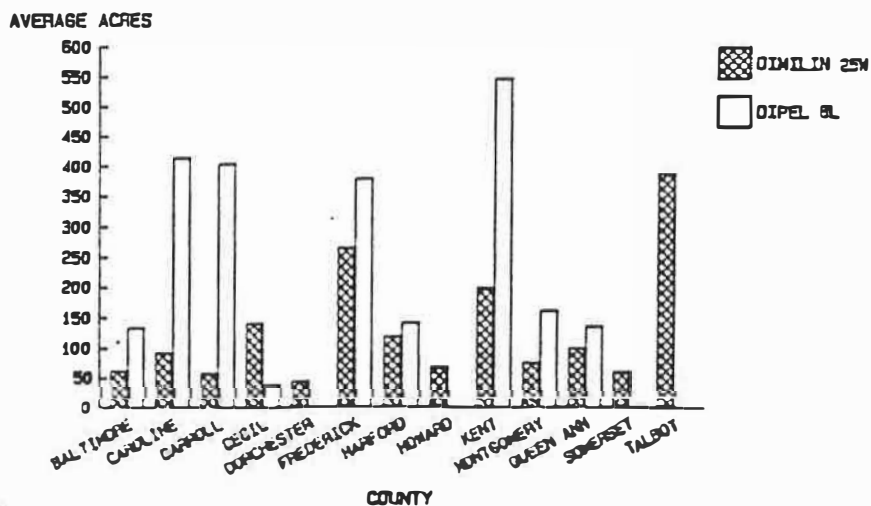


Figure 2.

AVERAGE BLOCK SIZE BY FORMULATION AND  
COUNTY IN MARYLAND - 1987



Note: Washington County had an average block size of 1035 acres for Dimilin 25W.

Figure 3.

## THURICIDE 64LV SPRAY BLOCKS - 1986

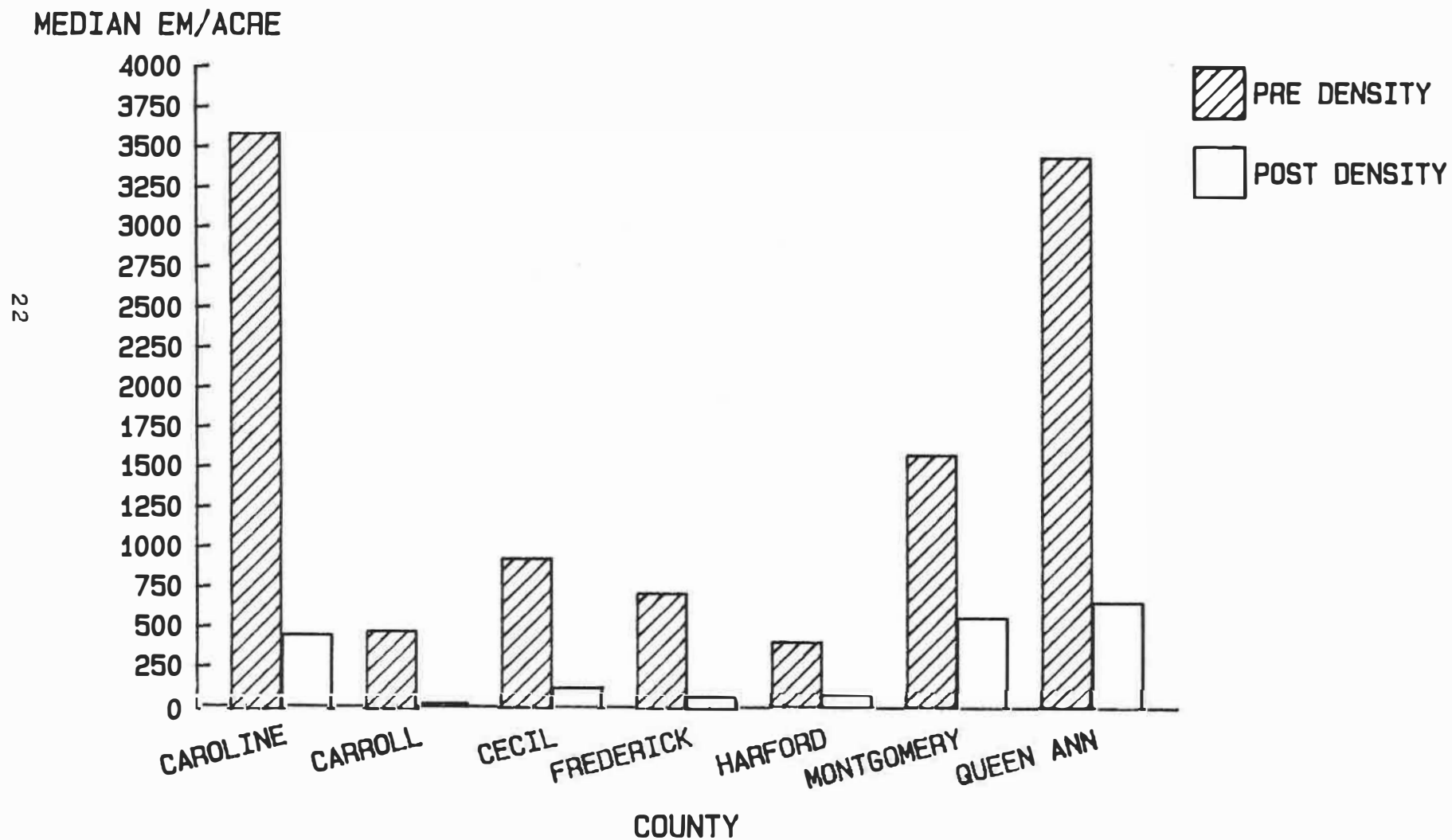


Figure 4.

## DIMILIN 25W SPRAY BLOCKS - 1986

MEDIAN EM/ACRE

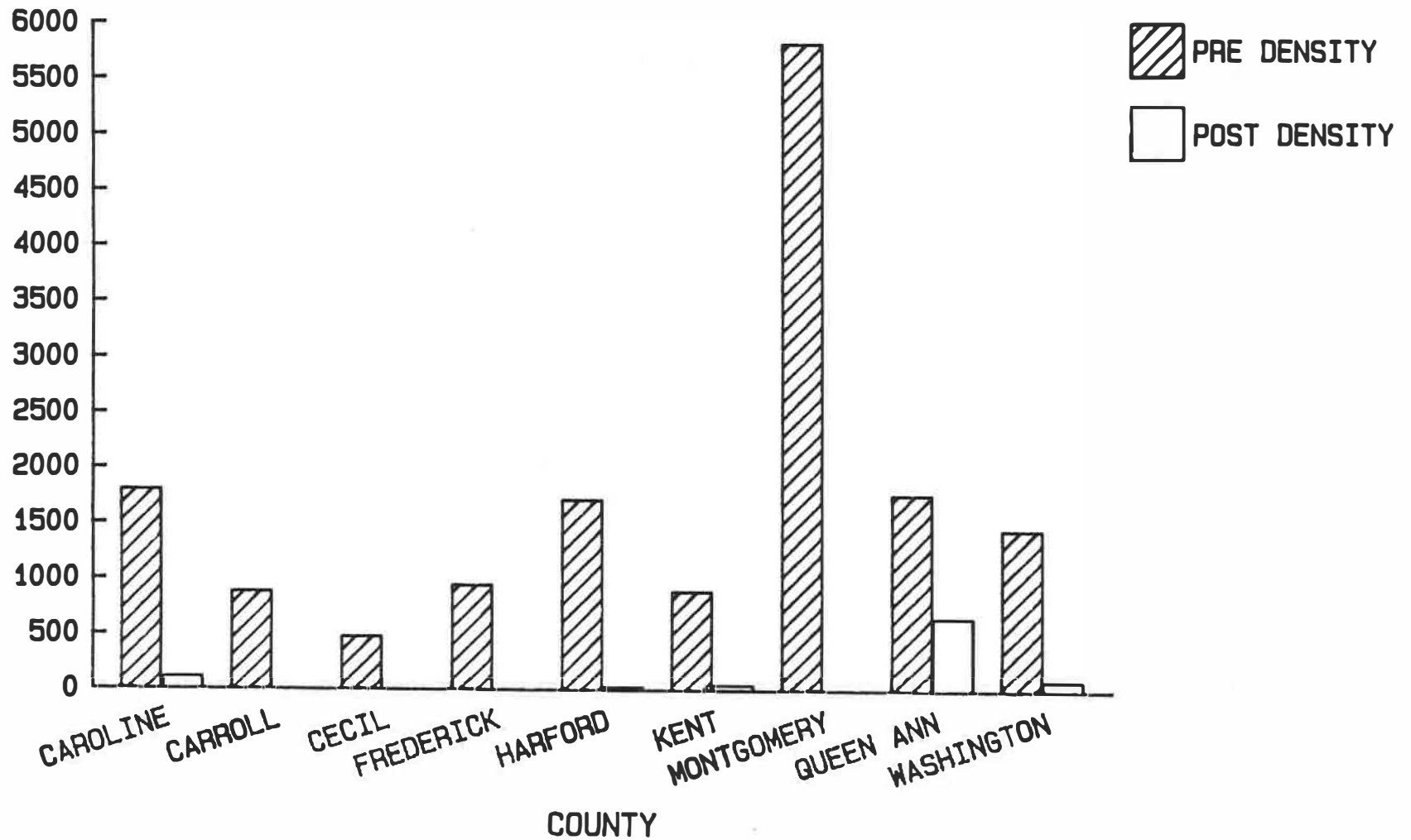
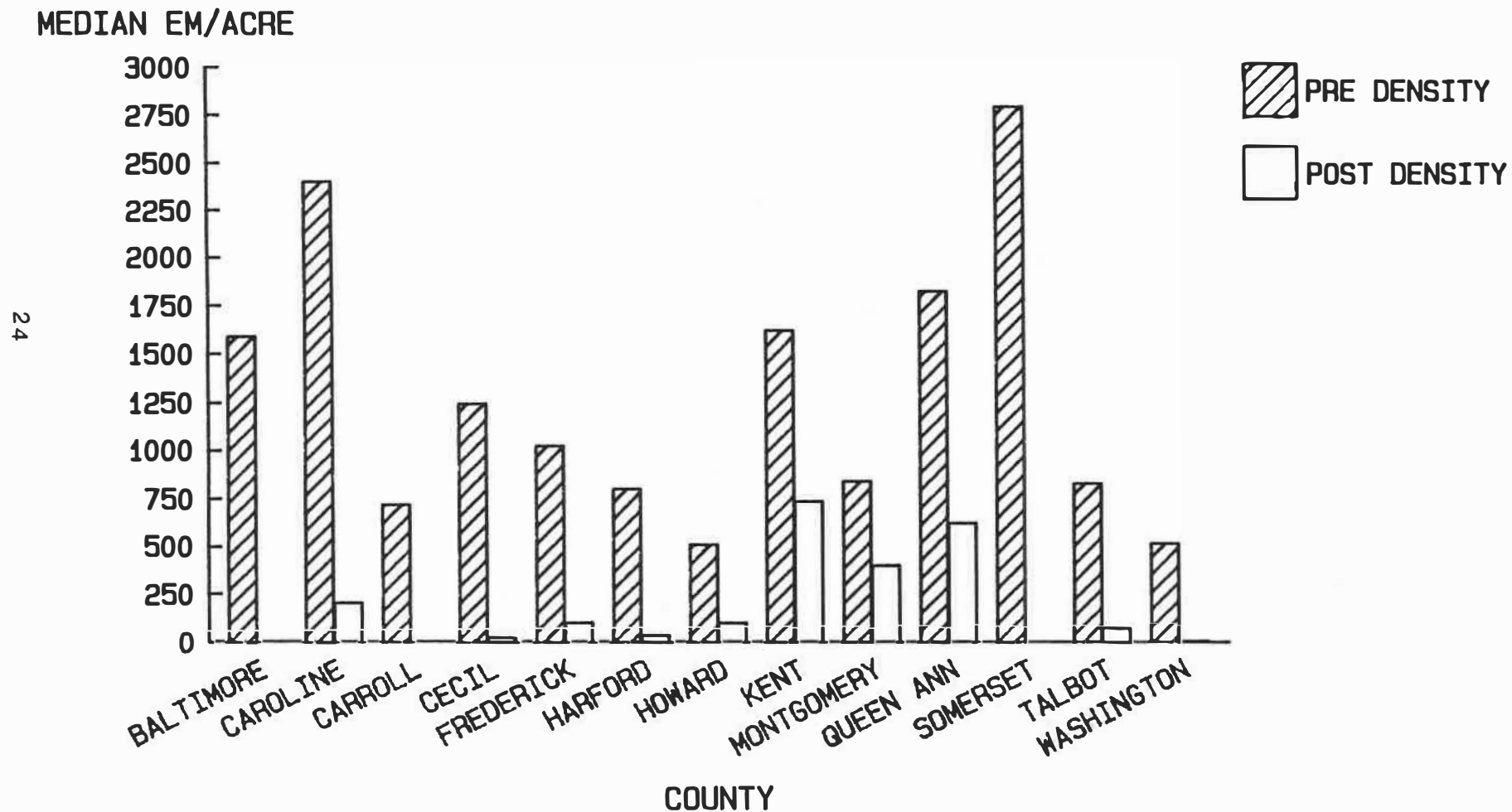


Figure 5.

## DIMILIN 25W SPRAY BLOCKS - 1987



Note: Dorchester County had 17040 median em/ac for pre-density and 0 median em/ac for post-density.

Figure 6.

## DIPEL 8L SPRAY BLOCKS - 1987

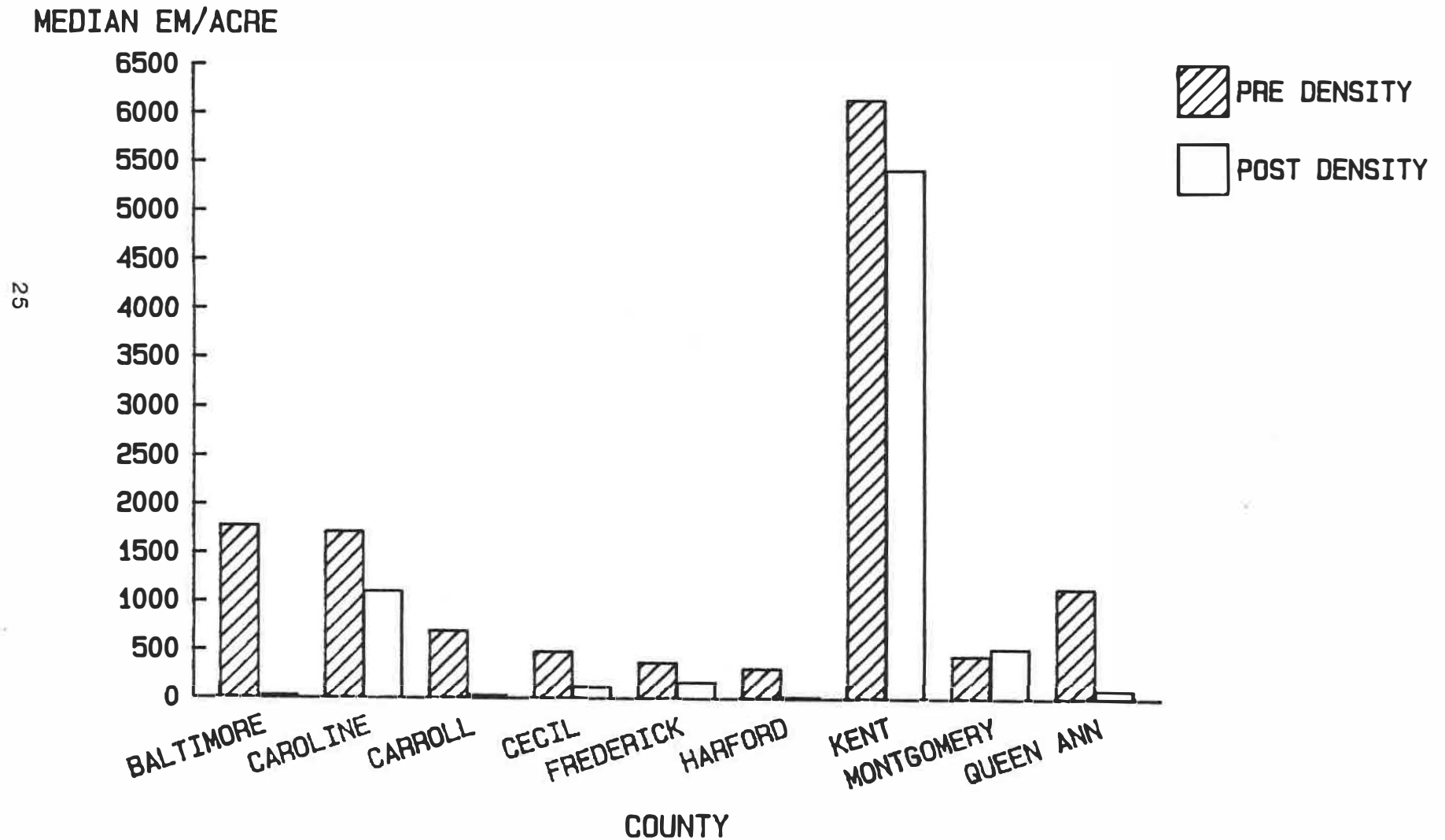
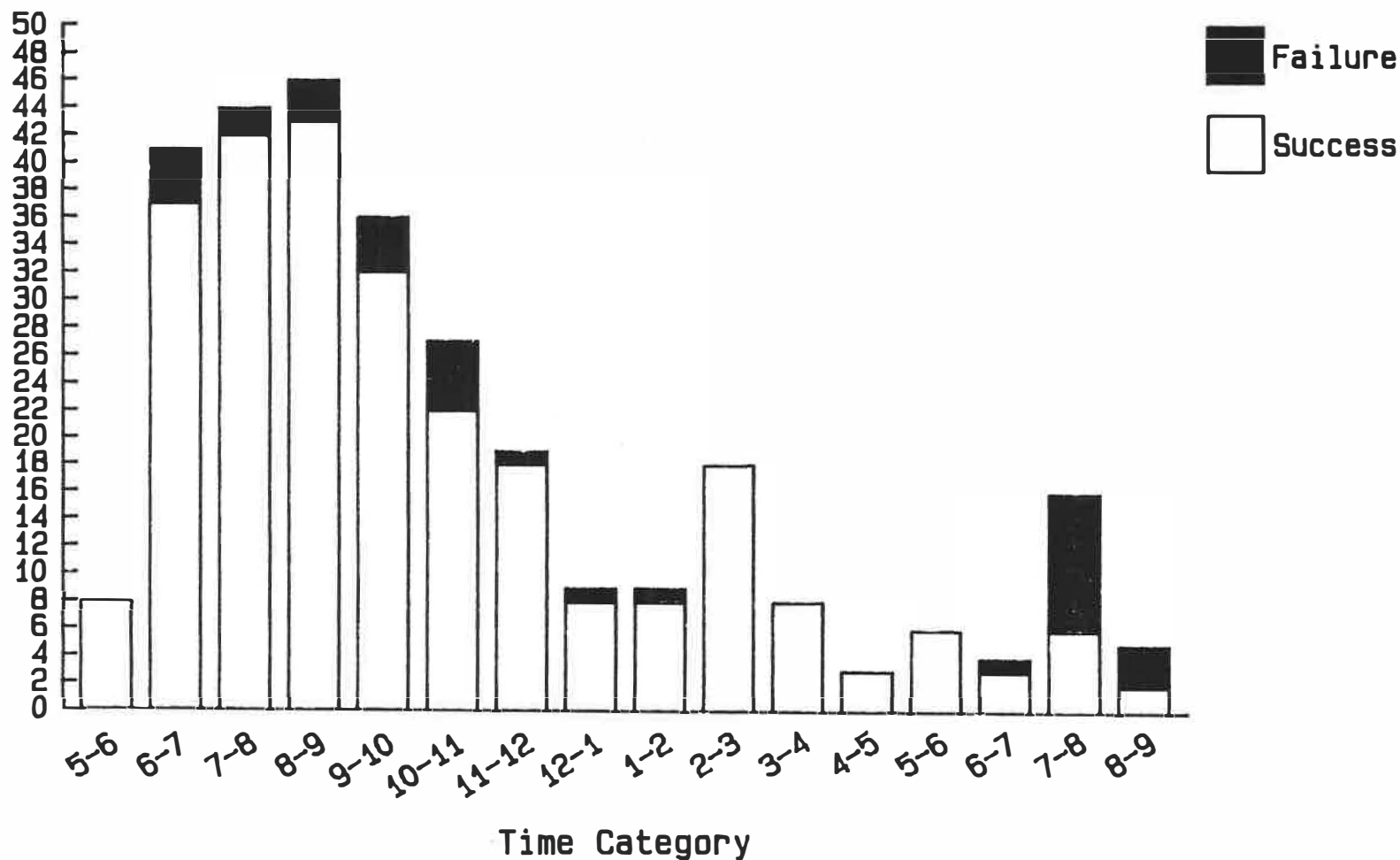


Figure 7.

## DIMILIN 25W TREATMENT TIMES - 1986

Total Blocks

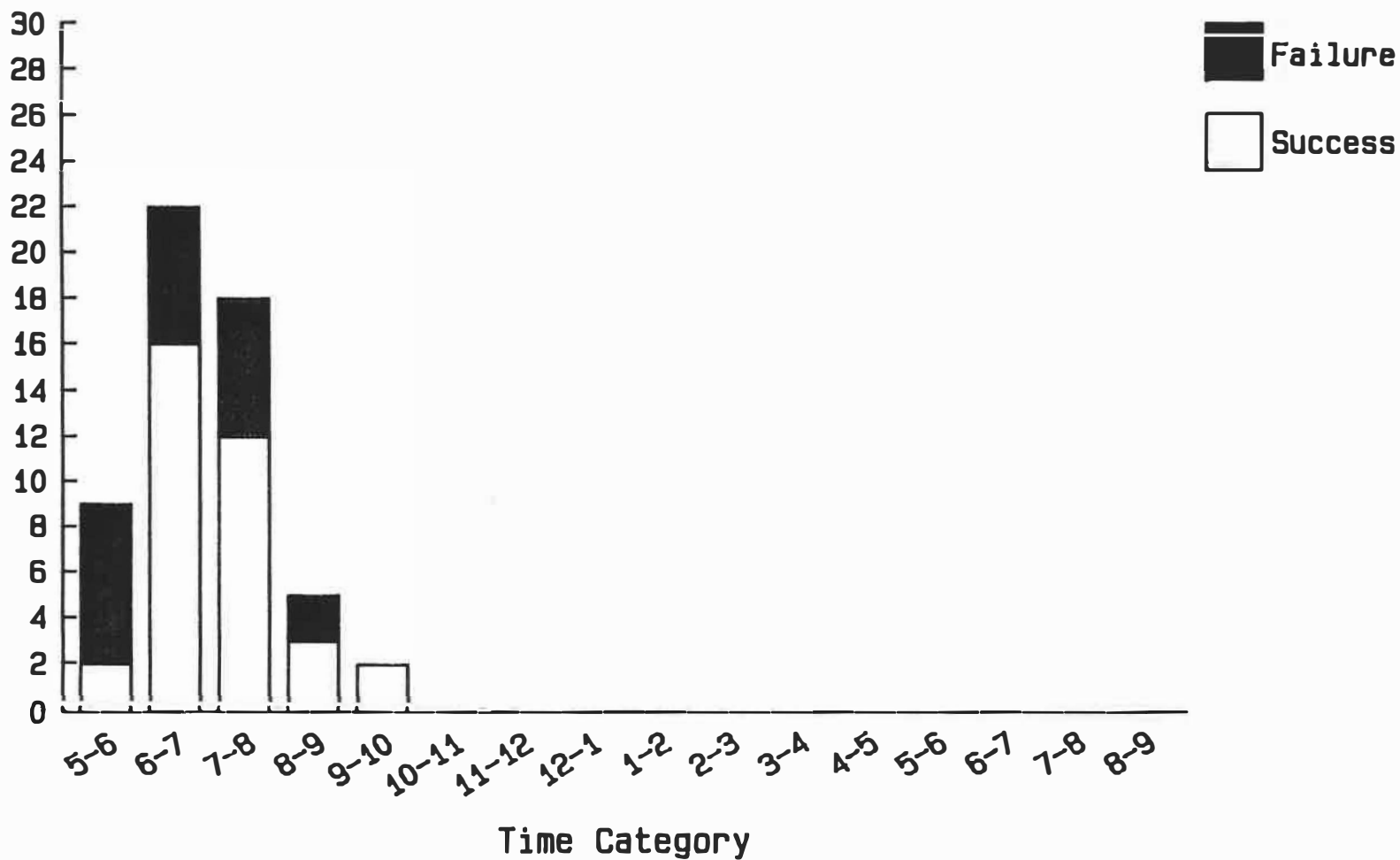


Note: A total of 299 blocks was sprayed with this formulation.

Figure 8.

## THURICIDE 64LV TREATMENT TIMES - 1986

Total Blocks



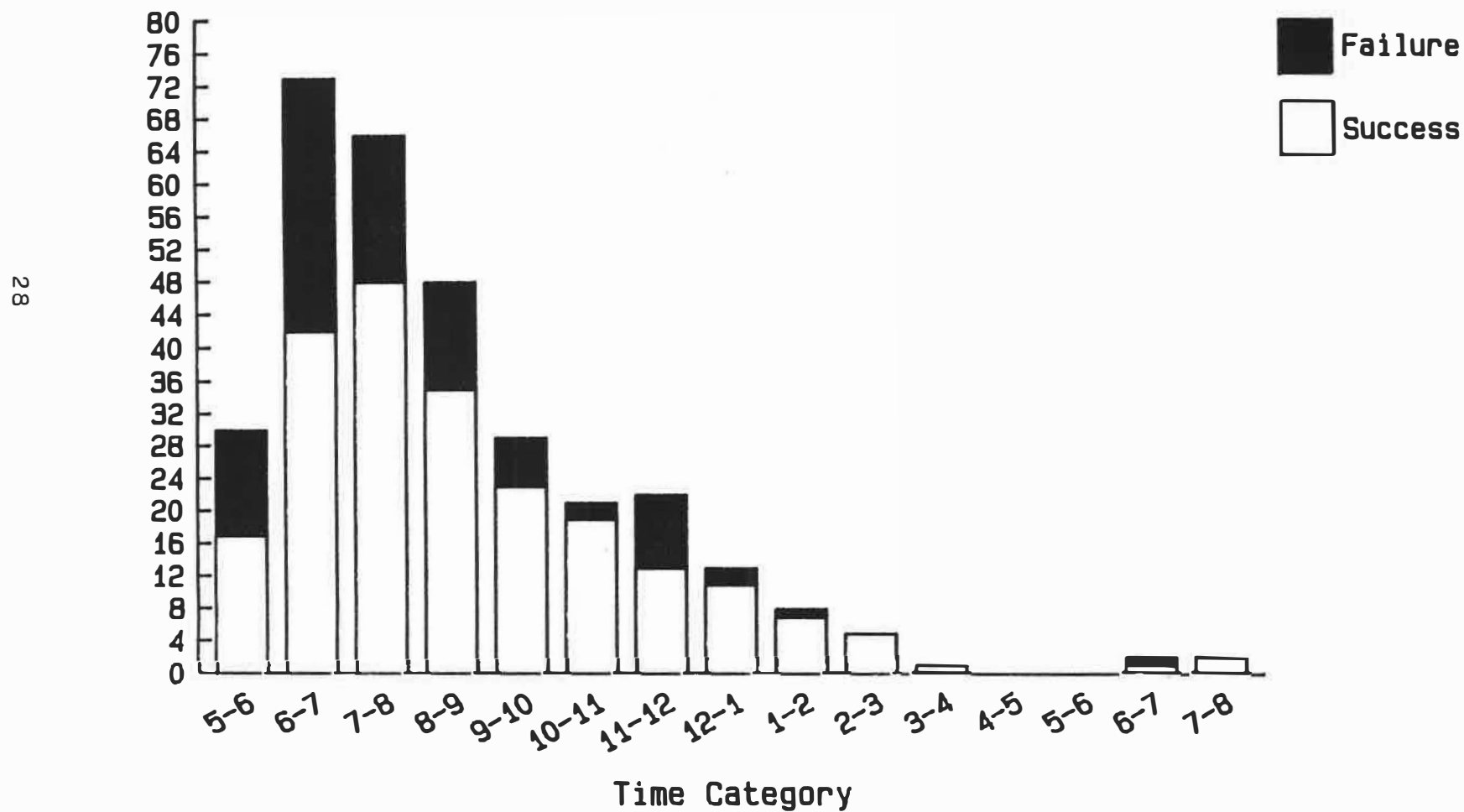
Note: A total of 56 blocks was sprayed with this formulation.



Figure 9.

## DIMILIN 25W TREATMENT TIMES - 1987

Total Blocks



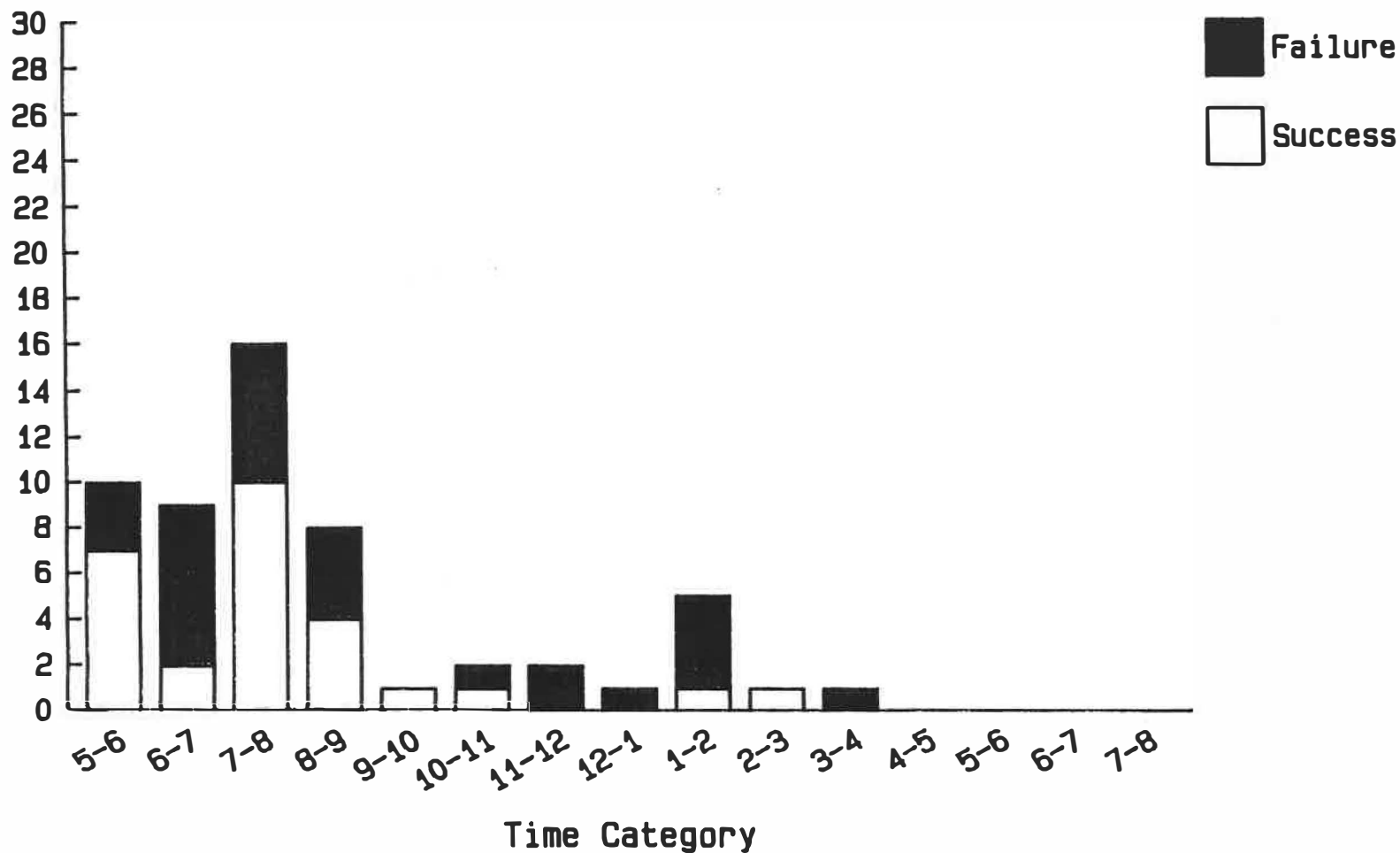
Note: A total of 320 blocks was sprayed with this formulation.

Figure 10.

## DIPEL 8L TREATMENT TIMES - 1987

Total Blocks

29



Note: A total of 56 blocks was sprayed with this formulation.

Figure 11.

## SUCCESSES AND FAILURES BY TAIL NUMBERS - 1987 DIMILIN 25W BLOCKS

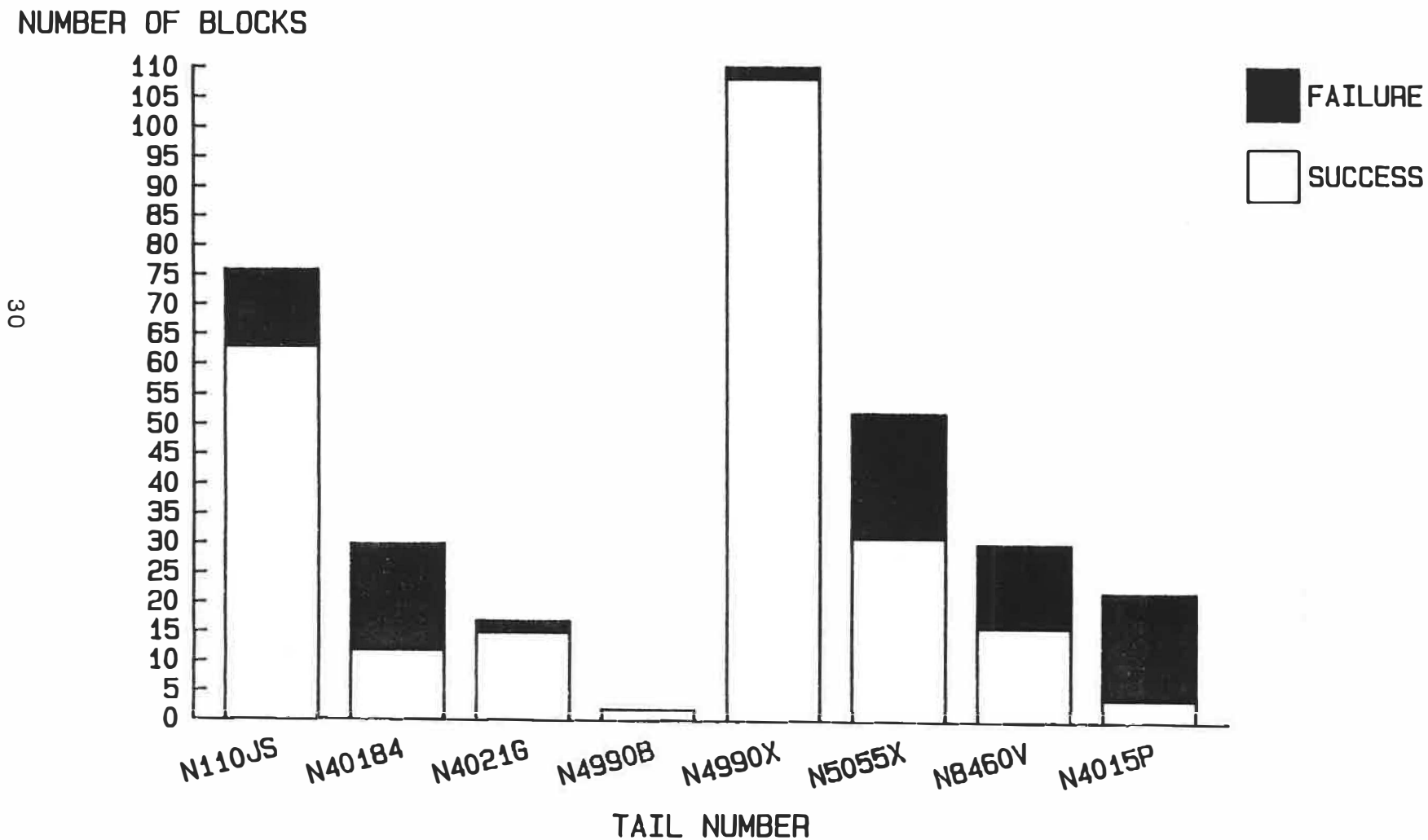


Figure 12.

# SUCSESSES AND FAILURES BY TAIL NUMBERS - 1987 DIPEL 8L BLOCKS

